Radiation Gateway Monitor Protocol

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RadNet Gateway Monitor Protocol
Thursday, February 19, 2004

RadNet Standard Header

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RadNet Message Header Format

The RadNet header contains the first 55 bytes of all RadNet messages. The header is intended to provide information regarding the operational status and location of an instrument. The header provides information regarding which instruments are (or are not) operating properly.

Field Name	Type	Position	Codes	Notes
Header Check Sum	Byte	1		The first byte (01, byte) is a checksum, to ensure the integrity of the header transmission. The checksum is the sum of bytes 2 through 55.
RadNet Version Number	Byte	2	See RadNet Versions Page	The second byte (02, byte) is the RadNet version number. It is used to indicate the version of the RadNet message. The receiving software is responsible for handling all received RadNet messages, although the most current version's functionality may not be provided.
Message Codes	Byte	3	See RadNet Message Codes Page	Byte (03) is the message code. The message code tells what type of RadNet message has been sent (status, check source, etc.).
Server Address	Word	4-5	None	Bytes (4-5) are the server address (1-64,536) of the pushing device. Since each instrument may perform as its own server, two bytes are used.
Monitor Address	Byte	6	None	Byte (6) is the address (1-256) of a specific monitor hooked up to a server. This protocol is intended to support existing (RS-485) systems. The practicality of hooking up more than 256 monitors to a single RadNet server is questionable.
Server Status	Byte	7	See RadNet Server Status Codes Page	Byte (7) is a code to display the status of the server. Codes are provided for normal as well as a variety of abnormal conditions.
Hardware Status	Byte	8	See Op/Hw Status Page Codes Page	Byte (8) is a code to display the overall Hardware Status of the instrument. Hardware status is intended to be a troubleshooting guide when responding to an abnormal condition. Instrument hardware malfunctions generally require repair work. Other conditions could be attributed to either hardware or operational problems. The instrument vendors are responsible for classifying conditions and prioritizing the status

				change. The intention is that only the most critical status change be pushed; however a series of messages based upon a list of status changes could also be pushed. For example: If the instrument detected failures with low voltage, and low background, then the vendor could push each status in a separate message (at the abnormal push rate). These statuses could then be interpreted by the client as a HV power supply failure.
Operational Status	Byte	9	See Op/Hw Status Page Codes Page	Byte (9) is a code to display the overall Operational Status of the instrument. Operational status is intended to be a troubleshooting guide when responding to an abnormal condition. Instrument operational problems generally require response by health physics personnel. Other conditions can be attributed to either hardware or operational problems. The instrument vendors are responsible for classifying conditions and prioritizing the status change. The intention is that only the most critical status change be pushed; however a series of messages based upon a list of status changes could also be pushed. For example: If the instrument detected failures with low voltage, and low background, then the vendor could push each status in a separate message (at the abnormal push rate). These statuses could then be interpreted by the client as a HV power supply failure.
Location	Char[40]	10-49	None	Bytes (10-49) are for the location of the instrument. Location designations are highly individual, so no convention or specification is given. The location label must be left justified. Unused characters must be padded with space charters.
Authentication Byte Count Offset	Word	50-51		The length in bytes of the original message. If non-zero, indicates that authentication is in effect. If zero, then authentication is not implemented See the following web pages for more information: Background Information RadNet Implementation, Authentication, Encryption

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Authentication Status	Byte	52	See RadNet Authentication Status Codes Page	"Invalid" flag. This byte is always set to zero when the message is transmitted. Authentication services set this byte to a non-zero value if the message fails signature verification. Clients check this byte with zero meaning valid data and take appropriate "bad data" action if the byte is non-zero. See the following web pages for more information: Background Information RadNet Implementation, Authentication, Encryption
Reserved For Future Use	Byte	53	None	Byte (53) is reserved for future use and must be filled with zero values until specified by the protocol
Monitor Type	Word	54-55	See RadNet Monitor Type Codes Page	Bytes (54-55) are a code for the instrument type.

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Gateway Monitor Body Format

The Gateway Monitor (GWM) body message has data conforming to Gateway Monitor Instrument formats and provides real-time GWM data. The Gateway Monitor body will tell you what type of Gateway Monitor message you received. The RadNet header contains the first 55 bytes of a RadNet message.

Field Name	Type	Position	Codes	Notes
R1	Float	56-59	N/A	Reserved for Future use
R2	Float	60-63	N/A	Reserved for Future use
Unique ID Preamble	Char [4]	C[1] = 64 C[2] = 65 C[3] = 66 C[4] = 67	N/A	The Unique ID Preamble is used in conjunction with the Unique ID. By combining Unique ID Preamble and the Unique ID we obtain a totally unique ID for the message. This ID is used to connect different GWM messages with each other and also allows two-database tables (RadNet messages) to be joined by a foreign key relationship. If another RadNet instrument is combined with a GWM, then the GWM will use the instrument Unique ID and Preamble ID for its messages. This use will allow the instrument reading and the GWM reading to be joined together at the monitoring computer or within a database. When deploying a "smart" GWM, it will look for packets from instruments within its area (using server and monitor address, or by IP address). When it sees a RadNet broadcast message, it will capture the Unique ID of the instrument, then it can create a GWM message and ship its reading using the captured Unique ID. Another method is to have the instrument look for the GWM packets and capture it's Unique ID, then use the GWM data for calculation. The instrument can send out the calculated readings onto the network using the GWM information and could use its own Preamble ID and the GWM 's Unique ID.

				The goal here is to be able to combine the GWM data with the instrument data and allow the end user to dictate how it would be implemented. How this is used would be defined by the needs of the end users. The GWM may handle the task, or instrument on the network, or users may want the monitoring computers to combine the data.
Unique ID	Float	68-71	N/A	Date + Time + any other unique value (e.g., mmddyyhhmmss + monitor address + server address = 1202970812970462). If multiple messages are sent, the Preamble ID+ Unique ID is used to match the multiple messages to one another as the client-monitoring computer receives them. See comments above..
GWM Message Type	Byte	72	See GWM Message Type Codes Page	This byte (72) is the GWM Message Type Code and is intended to provide information about the type of message being pushed. This information will indicate if there is transactional (or other) data following this byte.

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Gateway Monitor Measurement Footer

The Gateway Monitor (GWM) footer message has data conforming to generic GWM formats. A RadNet header and body must precede all footer messages. The header contains the first 55 bytes of a RadNet message, the GWM body contains the next 13 bytes, for a total of 72 bytes preceding the footer.

Repeating Frames of data are shown as (131+y)+10(x). The 131 represents the 131 bytes that precede the footer. The "y" is the number of bytes that have preceded the value in that channel frame. The number 10 is the number of bytes in the frame. The "x" is the number of channel iterations that have occurred before the byte value is examined.

See Gateway Monitor notes page for an example of the data stream format.

Note: Red Field Names = Repeating Fields

Field Name	Type	Position	Codes	Notes
Measurement Status	Byte	73	See GWM Measurement Status Codes Page	Byte (73) is the Measurement Status Code and is intended to provide information about the measurement that was performed.
User ID	Char[16]	74-89		Bytes (74-89) are the User ID. The format of this character string is not specified. The User ID must be left-justified. Unused characters must be padded with space characters.
Cargo ID	Char[16]	90-105		Bytes (90-105) are for the Cargo identification number. The format of this character string is not specified. The Cargo ID label must be left-justified. Unused characters must be padded with space characters. You can place a text message, bar code number, or RFID tag number.
Other	Char[16]	106-121		Bytes (106-121) are for other information. The format of this character string is not specified. The Other label must be left-justified. Unused characters must be padded with space characters. You can place a text message, bar code number, or RFID tag number.
Month	Byte	122		Byte (122) is the month of the year.
Day	Byte	123		Byte (123) is the day of the month.

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Year	Word	124-125		Bytes (124-125) are the year. This format includes all four digits of the year (1997, etc.)
Hour	Byte	126		Byte (126) is the hour of the day.
Minute	Byte	127		Byte (127) is the minute.
Seconds	Byte	128		Byte (128) is the second.
Number Of Detectors Alarmed	Byte	129		Byte (129) is the number of detectors that have alarmed.
Number Of Sum Zones Alarmed	Byte	130		Byte (130) is the number of alarmed Sum Zones. Sum zone alarms are detectors that are grouped to form functional zones, for the purpose of detecting distributed radiation.
Sum Channel Alarmed	Byte	131	See GWM Sum Channel Alarmed Codes Page	Byte (131) is a code for the existence of a summed channel alarm (yes or no).
Gamma Alarm Code	Byte	132	See GWM Alarm Codes Page	Byte (132) is a code for the existence of an gamma alarm.
Gamma Detector Number (highest)	Byte	133		Byte (133) is the numbers of alarmed gamma detectors (1-XX) or sum zone.
Gamma Side Code	Byte	134	See GWM Side Codes Page	Byte (134) is a code for which side of the body/item/vehicle caused an gamma alarm.
Highest Gamma Reading	Float	135-138		Bytes (135-138) are the highest gamma detector or sum zone reading in units of Bq. The anticipation is that this reading will be used in conjunction with an alarm state and can be used with all readings to demonstrate ALARA practices. Units = Bq
Neutron Alarm Code	Byte	139	See GWM Alarm Codes Page	Byte (139) is a code for the existence of a neutron alarm (yes or no).

Neutron Detector Number (highest)	Byte	140		Byte (140) is the number of alarmed neutron detectors (1-XX) or sum zone.
Neutron Side Code	Byte	141	See GWM Side Codes Page	Byte (141) is a code for which side of the body/item/vehicle caused a neutron alarm.
Highest Neutron Reading	Float	142-145		Bytes (142-145) are the highest neutron detector or sum zone reading in units of Bq. The anticipation is that this reading will be used in conjunction with an alarm state and can be used with all readings to demonstrate ALARA practices. Units = Bq
Speed Alarm Code	Byte	146	See GWM Speed Codes 0 = none 1 = maximum speed exceeded	Byte (146) is a code for the existence of a speed alarm.
Highest Speed Reading	Float	147 - 150		Bytes (147 – 150) are the speed of the object in m/s. Units = m/s
Number Of Channels	Word	151-152		Bytes (151-152) are the number of repeating footer frames that follow the body message. A zero value will indicate that there is no data in the repeating frame.
Channel Number	Word	[(153+26x)-(154+26x)]		The first byte [(153+26x)-(154+26x)] is the Channel Number/Detector Number presented in the frame and can be used as the detector number or a differentiator for multiple measurements from the same channel. Although not strictly required, since the frame length and number of frames are known, having the channel number in the frame can assist when troubleshooting. The intended use is as follows: If the GWM has 6 detectors of gross counts, the footer would contain 6 frames. If the GWM used multiple ROI's or could make multiple isotope identifications, a separate channel would be used for each ROI or isotope.

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Channel Type	Byte	(155+26x)	See Channel Types Page	Byte (155+26x) of the frame is a code for Channel Type.
Channel Hardware Status	Byte	(156+26x)	See Op/Hw Status Page	Byte (156+26x) is a code for the Hardware Status of the Channel.
Channel Operational Status	Byte	(157+26x)	See Op/Hw Status Page	Byte (157+26x) is a code for the Operational Status of the Channel.
Reading	Float	[(158+26x) - (161+26x)]		Byte [(158+26x) -(161+26x)] is the reading for the channel.
Units	Byte	(162+26x)	See RadNet Units Page	Byte (162+26x) is a code for the Units of the reading.
Highest Activity Isotope Identified	Char[16]	[(163+26x) - (178+26x)]		Byte (163+26x)-(178+26x) begins a 16 character string which identifies the highest activity isotope identified. The format of this character string is not specified. The Highest Activity Isotope Identified label must be left-justified. Unused characters must be padded with space characters.

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Gateway Monitor Spectrum Footer

The Gateway Monitor (GWM) Spectrum footer message has data conforming to generic GWM formats. A RadNet header and body must precede all footer messages. The header contains the first 55 bytes of a RadNet message; the GWM body contains the next 13 bytes, for a total of 72 bytes preceding the footer.

Repeating Frames of data are shown as (131+y)+10(x). The 131 represent the 131 bytes that precede the footer. The "y" is the number of bytes that have preceded the value in that channel frame. The number 10 is the number of bytes in the frame. The "x" is the number of channel iterations that have occurred before the byte value is examined.

The instrument shall ship raw Spectrum data only. Massaging of the spectrum data by the instrument is not allowed when using the RadNet protocol. This limit allows client/monitoring software to perform its own analysis.

See Gateway Monitor notes page for an example of the data stream format.

Note: Red Field Names = Repeating Fields

Field Name	Type	Position	Codes	Notes
Segment ID	Byte	73		Segment ID is the sequential identification number of segment that is being pushed. (e.g., Segment ID = 2 (2 OF 3) Number Of Segments = 3)
Number Of Segments	Byte	74		The number of segments is the total number of RadNet spectrum messages being pushed. If the Number Of Channels is > 512 channels then the GWM must ship the spectrum message in multiple messages.
Live Time	Float	75-78		The amount of time, during measurement, that the spectrometer is able to reliably resolve separate events in time. Live time is essentially the opposite of dead time. Dead time refers to the time that the nuclear-pulse electronics are busy processing one pulse and therefore cannot accept another. There are many methods (electronics, feedback) to correct for dead-time loss and beyond the scope of this discussion. Gamma-ray spectrometers are equipped with feedback electronics to track and correct for system dead time, reporting detector live time and real time during a measurement. Note: In connection with each spectrum

				analysis, it is critically important to account for live time in radionuclide quantification.
Real Time	Float	79-82		Clock time. The actual time period for the duration of a measurement. Real time is always less than live time. As count rate increases, real time becomes a smaller fraction of live time. Gamma-ray spectrometers are equipped with an internal clock to track and report real time.
Energy Calibration Offset	Float	83-86		It is necessary to establish a relationship between the channel of the ADC and the energy of the incoming photon in order to establish the radionuclide. This relationship is mostly linear, but to accommodate minor non-linearities, the ADC is calibrated to energy using the following second-order relationship: $E = \beta_0 + \beta_1 C + \beta_2 C^2$ Where E is photon energy, C is Channel of the ADC, and β_0, β_1, β_2 are calibration fit coefficients from a least-squares fit of the calibration data. β_0 is the calibration offset, the value of E on a calibration graph of C versus E, corresponding to channel zero (C=0). Note: In connection with each spectrum analysis, the energy calibration slope (β_0)and offset (β_1) terms are used to determine the channels that are used to perform the analysis of the spectrum. The analysis regions are determined in units of energy, not in units of channels, and hence stay the same. The energy calibration information can also be used to display the spectrum with an energy x-axis. Units = keV
Energy Calibration Slope	Float	87-90		Energy Calibration Slope, β_1 in the equation above, is used to reproduce the spectrum as a function of Energy (rather than Channel). The slope coefficient is determined

				through calibration, using a radionuclide of known gamma-ray energies, creating a table of energy versus channel, and performing a least-squares fit to the data.
Energy Calibration 2nd Order Term	Float	91-93		During the least-squares fit process associated with the calibration for energy, it is possible, though not likely, that a second-order non-linearity be introduced into relationship. Normally, the coefficient, β_2, is zero. In the event that the calibration is not statistically linear, this coefficient provides an estimate for the degree of nonlinearity.
Start Channel Number	Word	94-95		The Start Channel number is the starting channel number of the spectrum within this message, such as: Number Of Segments = 2 Segment ID = 1 Start Channel = 1 Stop Channel = 512 Number Of Channels = 512 Segment ID = 2 Start Channel = 513 Stop Channel = 1024 Number Of Channels = 512
Stop Channel Number	Word	96-97		The Stop Channel number is the ending channel number of the spectrum within this message. For example: Number Of Segments = 2 Segment ID = 1 Start Channel = 1 Stop Channel = 512 Number Of Channels = 512 Segment ID = 2 Start Channel = 513 Stop Channel = 1024 Number Of Channels = 512
Number Of Isotope Labels (NOIL)	Byte	98		NOIL is the number of repeating Isotope Labels (IL) contained within this message. If the GWM does not support this field, then 0 (zero) should be entered. **If the NOILs contains a 0 (zero)**

				then the next 6 fields will be omitted and byte 99 will be the scaling factor.
Isotope Label Start Energy (IL)	*Float*	[(99+81x)-(102+81x)]		*The Analysis Region Start Energy is the beginning energy for this IL(n) region.* *Units = keV*
Isotope Label Stop Energy (IL)	*Float*	[(103+81x)-(106+81x)]		*The Analysis Region Stop Energy is the ending energy for this IL(n) region.* *Units = keV*
Label	*Char[16]*	[(107+81x)-(122+81x)]		*The Label is the isotope label for this IL(n) or any other descriptor i.e. PU-239, U-235, Mixed, Mecial, etc.* *If the Label is <16 characters, then the unused bytes must be padded with space characters (ASCII Decimal 32)*
Reliability Index (confidence Index)	*Byte*	[(123+81x)-(123+81x)]	See Reliability Index Codes	*This Values is used to support draft ANSI Standard N42.34*
Comment(s)	*Char[40]*	[(124+81x)-(163+81x)]		*This value is used to hold comments concerning each IL. It can also be used to support ANSI Standard N42.34.* *Such as:* *Caution – SNM could be masked, Caution – interferences detected with signal, and so on.*
Reserved For Future Use	*8 Bytes*	[(164+81x)-(171+81x)]		*This is reserved space for future use.*
Scaling Factor	Float	[(172+24x)-(175+24x)]		Use this value to scale the largest reading to fit into the reading field, when the maximum number of counts/events > 64K. Client Software must take the reading multiplied by the scaling factor to obtain the actual results. e.g. For a reading of 88,480, the scaling factor would be 2.765 and the channel reading would be 32000 (32000 * 2.765 = 88480))
Number Of Channels (y)	Word	(176+24x)-(177+24x)]		The Number Of Channels is the number of readings/channels that will be presented as repeating frames.
Reading	*Word*	(((178+(24x))+		*Reading is the counts/events for each*

		2)+2y)) - (((179+24x))+ 2)+(2y))..n		*channel.*

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Gateway Monitor Spectrum Measurement Footer

The Gateway Monitor (GWM) Spectrum Measurement footer message has data conforming to generic GWM formats and used in conjunction with the GWM Spectrum Footer. A RadNet header and body must precede all footer messages. The header contains the first 55 bytes of a RadNet message; the GWM body contains the next 13 bytes, for a total of 72 bytes preceding the footer

Note: Red Field Names = Repeating Frames/Fields
Note:..n indicates a repeating frame of data

Field Name	Type	Position	Codes	Notes
Segment ID	Byte	73	N/A	Segment ID is the sequential identification number of the segment that is being pushed. i.e.. Segment Id = 2 (2 OF n) Number Of Segments = 3
Number Of Segments	Byte	74	N/A	The number of segments is the total number of RadNet Spectrum footers being pushed. If the spectrum is > 512 channels, then the instrument must ship the spectrum in multiple messages.
Live Time	Float	75-78	N/A	The amount of time, during measurement, that the spectrometer is able to reliably resolve separate events in time. Live time is essentially the opposite of dead time. Dead time refers to the time that the nuclear-pulse electronics are busy processing one pulse and therefore cannot accept another. There are many methods (electronics, feedback) to correct for dead-time loss and beyond the scope of this discussion. Gamma-ray spectrometers are equipped with feedback electronics to track and correct for system dead time, reporting detector live time and real time during a measurement. Note: In connection with each spectrum analysis, it is critically important to account for live time in radionuclide quantification.
Real Time	Float	79-82	N/A	Clock time. The actual time period for the duration of a measurement. Real time is always less than live time.

				As count rate increases, real time becomes a smaller fraction of live time. Gamma-ray spectrometers are equipped with an internal clock to track and report real time.
Calibration Month	Byte	83	N/A	Byte (83) is the month of the year
Calibration Day	Byte	84	N/A	Byte (84) is the day of the month
Calibration Year	Word	85-86	N/A	Bytes (85-86) are the year. This is all four digits of the year (1997, etc.)
Calibration Reference/Id	Char[20]	C[1]=87 C[2]=88 C[3]=89 C[4]=90 C[5]=91 C[6]=92 C[7]=93 C[8]=94 C[9]=95 C[10]=96 C[11]=97 C[12]=98 C[13]=99 C[14]=100 C[15]=101 C[16]=102 C[17]=103 C[18]=104 C[19]=105 C[20]=106	N/A	Used to reference the sample results to the calibration of the instrument The format of this character string is not specified. The Calibration Reference label must be left-justified. Unused characters must be padded with space characters.
Geometry Reference/Id	Char[20]	C[1]=107 C[2]=108 C[3]=109 C[4]=110 C[5]=111 C[6]=112 C[7]=113 C[8]=114 C[9]=115 C[10]=116 C[11]=117 C[12]=118 C[13]=119 C[14]=120 C[15]=121 C[16]=122 C[17]=123 C[18]=124 C[19]=125 C[20]=126		Used to reference the counting geometry for the sample data. The format of this character string is not specified. The Geometry Reference label must be left justified. Unused characters must be padded with space characters.
Isotope Library	Char[20]	C[1]=127	N/A	Used to reference the Isotopic Library

Reference/Id		C[2]=128 C[3]=129 C[4]=130 C[5]=131 C[6]=132 C[7]=133 C[8]=134 C[9]=135 C[10]=136 C[11]=137 C[12]=138 C[13]=139 C[14]=140 C[15]=141 C[16]=142 C[17]=143 C[18]=144 C[19]=145 C[20]=146		that was used to obtain the sample results. The format of this character string is not specified. The Isotope Library Reference label must be left justified. Unused characters must be padded with space characters.
Instrument Serial Number/Id	Char[20]	C[1]=147 C[2]=148 C[3]=149 C[4]=150 C[5]=151 C[6]=152 C[7]=153 C[8]=154 C[9]=155 C[10]=156 C[11]=157 C[12]=158 C[13]=159 C[14]=160 C[15]=161 C[16]=162 C[17]=163 C[18]=164 C[19]=165 C[20]=166	N/A	
Number Of Measurement	Word	167-168	N/A	Byte (167-168) is the number of repeating frames that are contained after this value
Isotope	char[16]	C[1]=169..n C[2]= 170..n C[3]= 171..n C[4]= 172..n C[5]= 173..n C[6]= 174..n C[7]= 175..n C[8]= 176..n C[9]= 177..n C[10]= 178..n	N/A	Isotope is the primary isotope(s) associated with this measurement. i.e. PU-239, U-239, Background, Radon, Medical, etc.

		C[11]= 179..n C[12]= 180..n C[13]= 181..n C[14]= 182..n C[15]= 183..n C[16]= 184..n		
Reading	Float	185-188..n	N/A	The calculated result for the Isotope.
Units	Byte	189..n	See RadNet Units Page	If the Isotope = CS-137, reading= 1.2, and the units set to 21 then the measurement would be 1.2 bq/m3 for CS-137.
Reading Percent Error or Absolute Error	Float	190-193..n	N/A	Reading Percent/Absolute Error is the error associated with the units above and is defined by the instrument manufacture. A common practice is to report percent relative standard deviation, which is the standard deviation divided by the mean value. Units = Same as units above, see byte 189
Detectability Limit	Float	194-197..n	N/A	The Lower Limit of Detection (LLD) is defined by the instrument manufacture. It has been interchangeably used with the term Minimum Detectable Activity (MDA). In either definition, the field name “Detectability limit” passes this value, for the given radionuclide activity. Units = see units above
Reserved For Future Use	Byte[40]	198-237..n	N/A	Reserved for Future use.

Note:..n indicates a repeating frame of data

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Gateway Monitor Time Slice Footer

The Gateway Monitor (GWM) Time Slice footer message has data conforming to generic GWM formats. A RadNet header and body must precede all footer messages. The header contains the first 55 bytes of a RadNet message, the GWM body contains the next 13 bytes, for a total of 72 bytes preceding the footer.

Repeating Frames of data are shown as (131+y)+10(x). The 131 represents the 131 bytes that precede the footer. The "y" is the number of bytes that have preceded the value in that channel frame. The number 10 is the number of bytes in the frame. The "x" is the number of channel iterations that have occurred before the byte value is examined.

See Gateway Monitor notes page for an example of the data stream format.

Note: Red Field Names = Repeating Fields

Field Name	Type	Position	Codes	Notes
Segment ID	Byte	73		Segment ID is the sequential identification number of segment that is being pushed. (E.g., Segment ID = 2 (2 OF 3) Number Of Segments = 3)
Number Of Segments	Byte	74		The number of segments is the total number of RadNet time slice messages being pushed. If the Number Of Channels is > 512 channels then the GWM must ship the time slice message in multiple messages.
Time slice Resolution	Float	75-78		The minimum elapsed time interval for each independent measurement in seconds. Units = seconds
Number of time slices	Word	79-80		The total number of independent Lapsed time intervals for each measurement. The data is presented as repeating frames of time slices. Each time slice may have multiple channels, as defined in “Number of Channels”.
Scaling Factor	Float	81-84		Use this value to scale the largest reading to fit into the reading field. When the maximum number of counts/events > 64K the client software must take the reading multiplied by the scaling factor to obtain the actual results. For example: For a reading (byte 81-84..n) of 88,480, the scaling factor would be 2.765 and the channel reading would be 32000 (32000 * 2.765 = 88480)
Number Of Channels (x)	Word	85-86		The Number Of Channels are the number of readings/channels that will be

				presented as repeating frames for each time slice.
Reading	*Word*	[(87+2x)-(88+2x)]		*Reading is the counts/events for each channel.*

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Gateway Monitor Status Message

The Gateway Monitor Status (GWM) Message is used to transmit the status of the instrument while it is collecting/analyzing the data. Because the GWM instrument may be required to collect data for several days or as long as a week before an analysis can be performed, RadNet provides this method to allow the instrument to inform the user of problem that may exist with the instrument during these long counting cycles.

If the "Number of Messages" field is set to 0, then no data will be found past byte 74. However, if "Number of Messages" is set to a value grater then 0, the instrument has sent a ASCII text message that can be displayed or archived. If the message is less than 40 characters long, the instrument will pad the remaining space with space characters (Hex value = 20x or decimal value = 32). If the text is greater than 40 characters then add another status message and increment the Number Of Messages field.

The instrument is still required to set the Operational and Hardware Status codes within the RadNet Header. Upon any status change within the instrument, the instrument shall push a status message and/or Measurement/Spectrum message.

When a valid analysis result has been determined by the instrument, it shall push the data using the Measurement and Spectrum message format. Then the instrument should resume sending this status message at the normal/abnormal push rates.

The instrument manufacturer is responsible for deciding to implement the support of text messages, though it is not a requirement of the RadNet protocol. This option may or may not be implemented on all instrumentation.

The instrument manufacturers will define what messages to support and their content. Instrument manufacturers will define how many messages will be combined into 1 RadNet packet. Some instrument manufacturers may combine messages to reduce overhead and network traffic, while others will send only one status message per packet.

See Gateway Monitor notes page for an example of the data stream format.

Here is an example of how this could be used:

Packet Number 1	Number Of Messages = 3	Message 0= 'Taking Background Reading' Message 1= 'Stabilizing detector' Message 2= 'Counting Sample'
Packet Number 2	Number Of Messages = 4	Message 0= 'Moving Sample' Message 1= 'Sample Placed' Message 2= 'Stabilizing The Detector' Message 3= 'Counting Sample"'
Packet Number 3	Number Of Messages = 1	Message 0= 'Count Complete, Analyzing Data'
Packet Number 4	Number Of Messages = 4	Message 0= 'Analysis complete' Message 1= 'Shipped Measurement' Message 2= 'Shipped Spectrum' Message 3= 'Standing By..'
Packet Number 5	Number Of Messages = 0	No extra status message sent, instrument using standard RadNet status messages to indicate the current state of the instrument.

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Field Name	Type	Position	Codes	Notes
Number Of Messages	Word	73-74	N/A	Byte (73-74) is the number of repeating messages (frames) that are after this value If Number Of Messages = 0 then the client software should ignore the remaining byte.
Status Message	Char[40]	C[1]=75 C[2]=76 C[3]=77 C[4]=78 C[5]=79 C[6]=80 C[7]=81 C[8]=82 C[9]=83 C[10]=84 C[11]=85 C[12]=86 C[13]=87 C[14]=88 C[15]=89 C[16]=90 C[17]=91 C[18]=92 C[19]=93 C[20]=94 C[21]=95 C[22]=96 C[23]=97 C[24]=98 C[25]=99 C26[]=100 C[27]=101 C[28]=102 C[29]=103 C[30]=104 C[31]=105 C[32]=106 C[33]=107 C[34]=108 C[35]=109 C[36]=110 C[37]=111 C[38]=112 C[39]=113 C[40]=114		If the "Number of Messages" field is set to 0, then no data will be found past byte 74. However, if "Number of Messages" is set to a value greater then 0, then the instrument has sent a ASCII text messages that can be displayed or archived. If the message is less than 40 characters long, then the instrument will pad the remaining space with space characters (Hex value = 20x or decimal value = 32). If the text is greater than 40 characters then add another status message and increment the Number Of Messages field.

Gateway Monitor Notes/Comments

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Gateway Monitor Message = 0 then see Gateway Monitor Measurement Footer Page. The Gateway Monitor Measurement Footer is pushed whenever there are any status changes or an abnormal push frequency. This footer is optional and is not needed if no additional channel data is supplied.

If Gateway Monitor Message = 1 then see Gateway Monitor Spectrum Footer Page. This setting should be instrument configurable (Turn on/off RadNet spectrum shipping). When spectrum shipping is turned on, the Gateway Monitor Spectrum Footer should be pushed after the measurement has been pushed whenever the monitor is alarmed. The monitor should always ship the measurement prior to shipping the spectrum.

If Gateway Monitor Message = 2 then see Gateway Monitor Spectrum Measurement Footer Page. This setting should be instrument configurable (Turn on/off RadNet spectrum measurement shipping). When spectrum measurement shipping is turned on, the Gateway Monitor Spectrum Measurement Footer should be pushed before the Gateway Monitor Spectrum Footer has been pushed whenever the monitor is alarmed or once a status change has occurred. The monitor should always ship the measurement prior to shipping the spectrum data.

If Gateway Monitor Message = 3 then see Gateway Monitor Time slice Footer Page. This setting should instrument configurable (Turn on/off RadNet time slice shipping). When time slice shipping is turned on, the Gateway Monitor Time Slice Footer should be pushed after the measurement has been pushed whenever the monitor is alarmed. The monitor should always ship the measurement prior to shipping the time slice data.

If Gateway Monitor Message =4 then see Gateway Monitor Status Message Footer Page. This setting should be instrument configurable (turn on/off RadNet Status shipping). When status shipping is turned on, the Gateway Monitor Status Footer is shipped whenever the instrument is ideal or no status change has occurred with the instrument. When the instrument has valid data or upon a status change, it will push data using the Measurement, Spectrum, or Time Slice format and can be used in conjunction with any other the other RadNet Gateway Monitor messages to inform the user of text messages. This message is not intend to be the only message being shipped by the instrument.

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Example Of Gateway Time Slice Message Format:

RadNet Field	Start Byte Position	End Byte Position	Notes
RadNet Header	1	55	
Gateway Monitor Body	56	72	
Start Of Time Slice Message Footer			
Segment ID	73	73	
Number Of Segments	74	74	
Time slice Resolution	75	78	
Number of time slices	79	80	
Scaling Factor	81	84	
Number Of Channels (x)	85	86	Number Of Channels Values = 10
Start Of Channels Repeating Frame Data			
Reading 0	87	88	
End of Channel 0 Data			
Reading 1	89	90	
End of Channel 1 Data			
Reading 2	91	92	
End of Channel 2 Data			
Reading 3	93	94	
End of Channel 3 Data			
Reading 4	95	96	
End of Channel 4 Data			
Reading 5	97	98	
End of Channel 5 Data			
Reading 6	99	100	
End of Channel 6 Data			
Reading 7	101	102	
End of Channel 7 Data			
Reading 8	103	104	
End of Channel 8 Data			

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Reading 9	105	106	
End of Channel 9 Data			
End Of Channels Repeating Frame Data			
End Of Time Slice Message Footer			

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Example of Gateway Monitor Status Message Format:

RadNet Field	Start Byte Position	End Byte Position	Notes
RadNet Header	1	55	
Gateway Monitor Body	56	72	
Start Of Status Message Footer			
Number of Messages	73	73	Number of Messages=4
Start Of Messages Repeating Frame Data			
Status Message 0	74	113	Status Message 0 Value= 'Moving Sample'
End of Status Message 0 Data			
Status Message 1	74	113	Status Message 1 Value = 'Sample Placed'
End of Status Message 1 Data			
Status Message 2	74	113	Status Message 2 Value= 'Stabilizing The Detector'
End of Status Message 2 Data			
Status Message 3	74	113	Status Message 3 Value = 'Counting Sample'
End of Status Message 3 Data			
End Of Messages Repeating Frame Data			
End Of Status Message Footer			

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Example of Gateway Monitor Spectrum Message Format:

RadNet Field	Start Byte Position	End Byte Position	Notes
RadNet Header	1	55	
Gateway Monitor Body	56	72	
Start Of Spectrum Message Footer			
Segment ID	73	73	
Number Of Segments	74	74	
Live Time	75	78	
Real Time	79	82	
Energy Calibration Offset	83	86	
Energy Calibration Slope	87	90	
Energy Calibration 2nd Order Term	91	93	
Start Channel Number	94	95	
Stop Channel Number	96	97	
Number Of Isotope Labels (NOIL)	98	98	Number NOIL Value = 4
Start Of IL Repeating Frame Data			
Isotope Label (IL) Number 0			
IL Start Energy	99	102	Value = 700
IL Stop Energy	103	106	Value = 800
IL Label	107	122	Value =”Co-60**********” * = ASCII Code 32
IL Reliability Index	123	123	Value = 0
IL Comments(s)	124	163	Value = “Caution – SNM could be masked**********” * = ASCII Code 32
IL Reserved For Future Use	164	171	Value = 0
End of IL 1 Data			
Isotope Label (IL) Number 1			
IL Start Energy	172	175	Value = 1200

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IL Stop Energy	176	179	Value = 1240
IL Label	180	195	Value =”Co-59*********” * = ASCII Code 32
IL Reliability Index	196	196	Value = 0
IL Comments(s)	197	236	Value = “Caution – SNM could be masked**********” * = ASCII Code 32
IL Reserved For Future Use	237	244	Value = 0
End of IL 2 Data			
Isotope Label (IL) Number 2			
IL Start Energy	245	248	Value = 1250
IL Stop Energy	249	252	Value = 1279
IL Label	253	268	Value =”Cs-137********” * = ASCII Code 32
IL Reliability Index	269	269	Value = 0
IL Comments(s)	270	309	Value = “Caution – SNM could be masked**********” * = ASCII Code 32
IL Reserved For Future Use	310	317	Value = 0
End Of IL 3 Data			
Isotope Label (IL) Number 3			
IL Start Energy	318	321	Value = 1300
IL Stop Energy	322	325	Value = 1310
IL Label	326	341	Value =”Cs-137********” * = ASCII Code 32
IL Reliability Index	342	342	Value = 0
IL Comments(s)	343	382	Value = “Caution – SNM could be masked**********” * = ASCII Code 32
IL Reserved For Future Use	383	390	Value = 0
End Of IL 4 Data			
End of IL Repeating Frame Data			
Scaling factor	391	394	Value = 2.364598
Number of Channels	395	396	Number Of Channels Value = 11

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Start of Number Channels Repeating Frames			
C0	397	398	
C1	399	400	
C2	401	402	
C3	403	404	
C4	405	406	
C5	407	408	
C6	409	410	
C7	411	412	
C8	413	414	
C9	415	416	
C10	417	418	
End of Number Channels Repeating Frames			
End Of Spectrum Message Footer			

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Example of Gateway Monitor Spec Measurement Footer Format:

RadNet Field	Start Byte Position	End Byte Position	Notes
RadNet Header	1	55	
GWM Body	56	72	See example above
Start Of Spectrum Message Footer			
Segment Id	73	73	Value = 1
Number of Segments	74	74	Value = 1 (1 of 1)
Live Time	75	78	Value = 30
Real Time	79	82	Value = 30
Calibration Month	83	83	Value = 1
Calibration Day	84	84	Value = 22
Calibration Year	85	86	Value = 2003
Calibration Reference Id	87	106	Value = "L1-2394-489-233*****" * = ASCII Code 32
Geometry Reference Id	107	126	Value = "L1-2394-489-233*****" * = ASCII Code 32
Isotope Library Reference Id	127	146	Value = "L1-2394-489-233*****" * = ASCII Code 32
Instrument Serial Number	147	166	Value = "12345-49589384984***" * = ASCII Code 32
Number Of Measurements	167	168	Value = 4
Start of Number Of Measurement Repeating Frames			
Isotope	169	184	"
Reading	185	188	
Units	189	189	
Reading Percent Error	190	193	

Detectability Limit	194	197	
Reserved For Future Use	198	237	
End Of Measurement 0 Data			
Isotope	238	253	
Reading	254	257	
Units	258	258	
Reading Percent Error	259	262	
Detectability Limit	263	266	
Reserved For Future Use	267	306	
End Of Measurement 1 Data			
Isotope	307	322	
Reading	323	326	
Units	327	327	
Reading Percent Error	328	331	
Detectability Limit	332	335	
Reserved For Future Use	336	375	
End Of Measurement 2 Data			
Isotope	376	391	
Reading	392	395	
Units	396	396	
Reading Percent Error	397	400	
Detectability Limit	401	404	
Reserved For Future Use	405	444	
End Of Measurement 3 Data			
End of Number of Measurement Repeating Frames			
End Of Measurement Message Footer			

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Example of Gateway Monitor Measurement Message Format:

RadNet Field	Start Byte Position	End Byte Position	Notes
RadNet Header	1	55	
Gateway Monitor Body	56	72	
Start Of Spectrum Message Footer			
Measurement Status	73	73	
User ID	74	89	
Cargo ID	90	105	
Other	106	121	
Month	122	122	
Day	123	123	
Year	124	125	
Hour	126	126	
Minute	127	127	
Seconds	128	128	
Number Of Detectors Alarmed	129	129	
Number Of Sum Zones Alarmed	130	130	
Sum Channel Alarmed	131	131	
Gamma Alarm Code	132	132	
Gamma Detector Number (highest)	133	133	
Gamma Side Code	134	134	
Highest Gamma Reading	135	138	
Neutron Alarm Code	139	139	

Neutron Detector Number (highest)	140	140	
Neutron Side Code	141	141	
Highest Neutron Reading	142	145	
Speed Alarm Code	146	146	
Highest Speed Reading	147	150	
Number Of Channels	151	152	Number Of Channels Values = 4
Start of Number Channels Repeating Frames			
Channel Number	153	154	
Channel Type	155	155	
Channel Hardware Status	156	156	
Channel Operational Status	157	157	
Reading	158	161	
Units	162	162	
Highest Activity Isotope Identified	163	178	
End Of Channel 0 Data			
Channel Number	179	180	
Channel Type	181	181	
Channel Hardware Status	182	182	
Channel Operational Status	183	183	
Reading	184	187	
Units	188	188	
Highest Activity Isotope Identified	189	204	

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End Of Channel 1 Data			
Channel Number	205	206	
Channel Type	207	207	
Channel Hardware Status	208	208	
Channel Operational Status	209	209	
Reading	210	213	
Units	214	214	
Highest Activity Isotope Identified	215	230	
End Of Channel 2 Data			
Channel Number	231	232	
Channel Type	233	233	
Channel Hardware Status	234	234	
Channel Operational Status	235	235	
Reading	236	239	
Units	240	240	
Highest Activity Isotope Identified	241	256	
End Of Channel 3 Data			
End of Number Channels Repeating Frames			
End Of Measurement Message Footer			

Gateway Monitor Alarm Codes

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Gateway Monitor Alarm Codes are for the existence of an alarm (yes or no).

Code	Meaning	Notes
0	No Alarms	"No Alarms" indicates that no alarms were received for this channel.
1	Detector Alarmed	"Detector Alarmed" indicates that there is at least one detector that alarmed. The "Neutron/Gamma Detector Number" displays the number of the alarmed detector with the highest contamination level.
2	Sum Zone Alarmed	"Sum Zone Alarmed" indicates that there is at least one sum zone that alarmed. The "Neutron/Gamma Number Of Sum Zones Alarmed" is the number of alarmed sum zones.
3	Sum Channel Alarmed	"Sum Channel Alarmed" indicates that there is at least one sum channel alarm. "Sum Channel Alarmed" will indicate a value of "1" (true).

Gateway Monitor Reliability Index Codes

Gateway Monitor Reliability Index Codes are used and support of ANSI 42.34 for Identifiers. These codes will

Code	Meaning	Notes
0	Not Used or N/A	Indicates that this option is not support by the instrument

Gateway Monitor Measurement Status Codes

Byte (57) is the Measurement Status Code and is intended to provide information about the measurement that was performed.

Code	Meaning	Notes
0	Normal	"Normal" is intended to indicate that the measurement was normal.
1	Alarmed	"Alarmed" is intended to indicate that the measurement resulted in an alarm.
2	Aborted	"Aborted is intended to indicate that the measurement was aborted.

Gateway Monitor Message Type Codes

Gateway Monitor (GWM) Message Type Codes used to indicate the type of message being transmitted.

Code	Meaning	Notes
0	Measurement	GWM Measurement Data Follows the GWM body. See **Gateway Monitor Measurement Page** for more information.

1	Spectrum	GWM Spectral Data Follows the GWM body. See **Gateway Monitor Spectrum Page** for more information
2	Spectrum Measurement	GWM Spectral Measurement Data Follows the GWM body. See **Gateway Monitor Spectrum Measurement Page** for more information
3	Time Differentiated	GWM Time Differentiated Follows the GWM body. See **Gateway Time Slice Page** for more information
4	Status	GWM Status Follows the GWM body. See **Gateway Status Page** for more information

Gateway Monitor Speed Codes

Byte (116) is a code is used to indicate the movement of the item has been exceeded.

Code	Meaning	Notes
0	None	
1	Maximum Speed exceeded	

Gateway Monitor Sum Channel Alarmed Codes

Byte (116) is a code for the existence of an alarm (yes or no).

Code	Meaning	Notes
0	False	"False" is intended to indicate that there is not a sum channel alarm.
1	True	"True" is intended to indicate that there is sum channel alarm.

Standard RadNet Header Codes

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Authentication Status Codes

See the following pages for more information concerning RadNet Security Implementation:

Background Information
RadNet Security Implementation
Authentication
Encryption

These codes indicate whether a RadNet message has been authenticated (message fails signature verification). RadNet message(s) are directed to/at a RadNet Authentication Server (RAS) or other device. The RAS will authenticate the message and set byte 52 to indicate the status of the authentication process. The RAS server will then forward the message to clients on the network. It is important that the RAS server is secure and that the data leaving the RAS server is on a secure network (the message will not be tampered with after authenticated). It is also important to note that the RAS server does not strip the authentication keys from the message, and the authentication process could be done at any time, including storing the authentication signature within a database for future verification of the message.

The Authentication software/server will set this byte value to indicated message signature verification status.

Code	Meaning	Notes
0	Message is Ok	
>0	Message fails signature verification.	

Standard RadNet Header Codes

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RadNet Channel Types

Below is a code for type of channel.

Code	Meaning	Notes
0	Alpha	
1	Beta	
2	Gamma	
3	Neutron	
4	Iodine	
5	Noble Gas	
6	Tritium	
7	Stack Flow	
8	Sample Flow	
9	Temperature	
10	Sample Pressure	
11	Leak rate	Primary to secondary, or containment building leak
12	Reactor power	Used for leak measurements
13	Beta + Gamma	The sum of the beta and gamma channels.
14	Latitude	
15	Longitude	
16	Altitude	
17	Humidity	
18	Wind Speed	
19	Wind Direction	
20	Alpha/Beta	
21	Pulse Height Analysis (PHA)	
22	Dust Particle	
23	Humidity	
24	Anemometer	

Standard RadNet Header Codes

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RadNet Monitor Type Codes

Bytes (54-55) are code for the instrument type.

Code	Meaning	Notes
0	Gamma Area Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
1	Gamma Crit Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
2	Neutron Area Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
3	Neutron Crit Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
4	Alpha CAM	Uses the Alpha CAM body, Measurement Footer, Spectrum Footer. See Alpha CAM Header, Body, Measurement Footer, Spectrum Footer and Notes for more information.
5	Beta CAM	Uses the Beta Cam body and footer format. See Beta CAM Header, Body, Footer and Notes for more information.
6	PCM Monitor	Uses the PCM body and footer format. See PCM Header, Body, Footer and Notes for more information.
7	PCM Portal Monitor	Uses the PCM Body and Footer format. See Portal Header, Body, Footer and Notes for more information.
8	PING	Uses the PING Body and Footer format. See PING Header, Body, Footer and Notes for more information.
9	Glove Box Monitor/Hand Monitor	Uses The PCM Body and Footer format. See PCM Header, Body, Footer and Notes for more information.

Standard RadNet Header Codes

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10	Hand And Foot Monitor	Uses The PCM Body and Footer format. See Hand and Foot Header, Body, Footer and Notes for more information.
11	Generic Sensor	Uses The Generic Sensor Body and Footer format. See Generic Sensor Header, Body, Footer and Notes for more information.
12	Electronic Reading Dissymmetry	See Header, ERD Body, ERD Footer, for more information.
13	Item Contamination Monitor (ICM)	Uses The ICM Body and Footer format. See Header, Body, Footer and Notes for more information.
14	Radiation Gateway Monitor	Uses The Radiation Gateway Body and Footer format. See Header, Body, Footer and Notes for more information.
15	Gamma Spectrum	Uses The Gamma Spectrum Body, Measurement, Spectrum, Status and Footer format. See Header, Body, Measurement, Spectrum, Status and Notes for more information.
16	Portable Instruments	Protocol Pending, in development by vendor
17	Meteorology Tower	Uses The Meteorology Tower Body and Footer format. See Header, Body, Measurement, Status, and Notes for more information.
18	Video	Uses The Video Body, Status and Footer format. See Header, Body, Footer, Status and Notes for more information.
19	Image	Protocol Pending, in development by vendor
20	Audio	Protocol Pending, in development by vendor
21	Security data tag/seal	Protocol Pending, in development by vendor
22	Tritium Air Monitor	Protocol Pending, in development by vendor
23	Dust Particle Monitor	Protocol Pending, in development by vendor

Standard RadNet Header Codes

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RadNet Message Codes

Byte (03) is the message code. The message code indicates what type of RadNet message has been sent (status, check source, etc.).

Code	Meaning	Notes
0	Normal/Standard RadNet Message	Message is pushed by the instrument and received by the clients.
1	Alarm Ack	Message is pushed by the clients and received by the instruments. See Alarm Acknowledge Alarm Msg. Notes and Alarm Acknowledge Header Format
2	Pass Through	Message is pushed by the instrument and received by the client or can be pushed by the client and received by the instrument. This method can be used for bi-directional communication by the clients and instruments. See Pass Through Msg. Header Notes / Pass Through Header Format or Pass Through Codes
3	Check Source	Message is pushed by the clients and received by the instruments. See Check Source Msg. Notes and Check Source Header Format
4	Diagnostic/Self-Check	Message is pushed by the clients and received by the instruments. See Diagnostic/Self-Check Msg. Notes and Diagnostic/Self-Check Header Format
5	Request Data	A client/server sends this request to an instrument. In response to this request the instrument will send its current information (Normal RadNet Message). See Request Data Notes and Request Data Header Format
6	Update/Request Date/Time	A client/server sends this request to an instrument. In response to this request the instrument will send/set the date/time. See Update/Request Date/Time Notes and Update/Request Date/Time Header Format
7	Acknowledge Receipt	This message is used by the monitoring computer to acknowledge receipt of data from an instrument. See Acknowledge Receipt Message Header Format and Acknowledge Receipt Message Notes for more information.
255 (FFh)	Encrypted RadNet Message	See the following pages for more information: Background Information RadNet Implementation Encryption Header Message Format

Standard RadNet Header Codes

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		Encryption Background Information

Standard RadNet Header Codes

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RadNet Operational and Hardware Status Codes

Note: It is the responsibility of the instrument manufacturer to prioritize the operational and hardware status for the instrument. Any status code can be used either as an operational or hardware status code base upon the instrument usage or needs.

Below is a code used to display the Hardware/Operational Status of the instrument. Hardware status is intended to be a troubleshooting guide when responding to an abnormal condition. Instrument hardware malfunctions generally require repair work. Other conditions may be attributed to either hardware or operational problems. Instrument vendors are responsible for classifying conditions and prioritizing the status change. The intention is that only the most critical status change be pushed; however a series of messages based upon a list of status changes could also be pushed. For example: If the instrument detected failures with low voltage and low background, the vendor could push each status in a separate message (at the abnormal push rate). These statuses could then be interpreted by the client as an HV power supply failure.

OP = Guide For Operational Status Use
HW = Guide For Hardware Status Use

Code	Meaning	OP	HW	Notes
0	Normal	Y	Y	
1	High Alarm	Y	N	
2	HV Fail	N	Y	
3	Count Fail	Y	N	
4	Bkg Fail	Y	N	
5	Bkg Update	Y	N	
6	Comm Fail	N	Y	
7	Gas Empty	Y	N	
8	Buffer Full	Y	Y	
9	Acked High Alarm	Y	N	
10	Flow Fail Low	Y	Y	
11	Flow Fail High	Y	Y	
12	Filter Door Open	Y	N	
13	Instrument Not Ready	Y	Y	
14	Instrument In Calibration Mode	Y	Y	
15	Fast Concentration Alarm	Y	N	
16	Slow Concentration Alarm	Y	N	
17	DAC Hours Alarm	Y	N	
18	Count Rate Alarm	Y	Y	

19	Release Rate Alarm	Y	N	
20	Fast Concentration Alarm Disabled	Y	N	
21	Slow Concentration Alarm Disabled	Y	N	
22	Count Rate Alarm Disabled	Y	N	
23	Check Source Mode	Y	N	
24	Out Of Service	Y	Y	
25	Alert Alarm	Y	N	
26	Trend Alarm	Y	N	
27	Not Initialized	Y	Y	
28	Standby	Y	Y	
29	Local Control	Y	Y	
30	Flush	Y	N	
31	Alarm Disabled	Y	N	
32	External Fail	Y	Y	
33	AC Off	Y	Y	
34	Crit Relay Fail	Y	Y	
35	Out Of Limits	Y	Y	
36	Crit Alarm	Y	N	
37	NV RAM Fail	N	Y	When the instrument's non-volatile RAM cannot be read/written.
38	Check Source Results	N	Y	Indicates that the message with this status carries check source results. This indicates that this message contains the final check source result at the completion of the check source integration. Prior to this code being sent the status code would be 23 (*Check Source Mode*).
39	Audio Failure	N	Y	Indicates that the instrument has a problem with its audio circuit.
40	Over Range	Y	Y	Indicates that the instrument has exceeded an Over Range value.
41	Diagnostic/Self-check completed, Passed self-check	Y	Y	Indicates that the instrument has performed an Internal Diagnostic/Self-check and found no error conditions. See Diagnostic/Self-Check Msg. Notes and Diagnostic/Self-Check Header Format

42	Diagnostic/Self-check completed, Failed self-check	Y	Y	Indicates that the instrument has performed an Internal Diagnostic/Self-check and found error conditions. See Diagnostic/Self-Check Msg. Notes and Diagnostic/Self-Check Header Format
43	High/High Alarm	Y	N	Third alarm level used in many plants.
44	Internal stabilization failure	Y	N	From automatic energy stabilization.
45	Parameter error	Y	N	Bad setup.
46	Temperature failure	N	Y	Temperature out of operational range.
47	Power supply failure	N	Y	From power supply, or from voltage reading.
48	Analog input failure	N	Y	4-20 mA analog input failure (0 mA for example).
49	Filter failure	N	Y	Automatic filter advance failure (motor, end of roll…).
50	Detector cable failure	N	Y	
51	Electronic or Acquisition board failure	N	Y	Electronic failure.
52	Low Battery	N	Y	Backup battery or internal battery has a low voltage condition.
53	Battery Failed	N	Y	Backup battery or internal battery has failed.
54	Clock Failed	N	Y	Internal clock has failed.
55	User defined	Y	Y	This error code is used whenever an instrument supports user defined error codes. It is used whenever there is a desire to inform a user that one of their error conditions has been reached. Since there is no way of knowing what is contained in the error code logic, this generic response should be used to indicate the error.
56	Internal Communication Failure	N	Y	

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RadNet Versions

Note: The last approved version in this list is the current version in use by RadNet.

The second byte (02, byte) is the RadNet version number. This number is used to indicate the version of RadNet be pushed by the server. It is the responsibility of the receiving software to handle all received RadNet messages, although the most current version's functionality may not be provided.

Version	Date Approved	Notes
0	Approved	

Standard RadNet Header Codes

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RadNet Units Codes

Below is a code for the RadNet units of the reading.

Code	Meaning	Notes
0	cps	
1	Rem/hr	
2	R/hr	
3	Sv/hr	
4	Bq/cm3	
5	Bq	
6	Degrees Centigrade (C)	Temperature Unit
7	Pascal (Pa)	Pressure Unit
8	cc	Flow Volume Unit
9	cc/sec	Flow Rate Unit
10	cps/cc	Activity Unit
11	counts	Counting Events Unit
12	cm/sec	Velocity Unit
13	bqMeV/cc	Gamma Gas Activity
14	degrees	Wind Direction (180 = south)
15	Gy/hr	Dose Rate Unit
16	RPU%	Reactor Power Unit
17	Kg/sec	Masse flow rate
18	n/cm2	Neutrons / cm2
19	n/cm3	Neutrons / cm3
20	DAC	Derived Air Concentration
21	bq/m3	Becquerel per cubic meter
22	bq/kg	Becquerel per kilogram
23	Latitude	
24	Longitude	
25	Mu_Hemin	Hemisphere North
26	Mu_Hemis	Hemisphere South
27	Mu_Hemie	Hemisphere East
28	Mu_Hemiw	Hemisphere West
29	Mu_Knots	Wind Speed (knots)
30	Mu_KPH	Wind Speed (knots per hour)
31	Mu_MPS	Wind Speed (meters per second)
32	Mu_MPH	Wind Speed (meters per hour)

Standard RadNet Header Codes

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33	Mu_METERS	Altitude (meters)
34	Mu_Feet	Altitude (feet)
35	Mu_Percent	Humidity
36	Resistance	Electrical Resistance
37	µm	Micro-meter

Standard RadNet Header Codes

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RadNet Server Status Codes

Byte (7) is a code that displays the status of the server. Codes are provided for normal as well as a variety of abnormal conditions. See Appendix A for Server Status message codes.

Code	Meaning	Notes
0	Normal Operation	
1	Instrument Communication Error	
2	TCP Communication Error	
3	UDP Communication Error	
4	Hard Disk Full	
5	Password Fail	
6	Starting Up	
7	Shutting Down	
8	Program Error	
9	NetWork Access Granted	
10	NetWork Access Denied	